

Canadian MSAT Field Trial Program User Requirements

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ABSTRACT

A wide range of mobile satellite service offerings will be available in late 1993 with the launch of Canada's first satellite devoted almost exclusively to mobile and transportable services. Early mobile satellite service offerings and field trials will be available through leased satellite capacity. During the last 7 years the Department of Communications has been meeting with potential MSAT (Mobile SATellite) users in government and the private sector as part of a \$20M Communications Trials Program. User trials will be conducted using leased capacity as well as capacity on Canada's MSAT satellite.

This paper will discuss user requirements identified under the Communications Trials Program. Land, marine, aeronautical and fixed applications will be described from the perspective of the end-users. Emphasis will be placed on field trials being accomplished using leased capacity such as the marine data trial being implemented by Ultimateast Data Communications, trials utilizing transportable briefcase terminals and additional field trials being considered for implementation with the TMI Mobile Data Service.

The pre-MSAT trials that will be conducted using leased capacity are only a limited sample of the overall end-user requirements that have been identified to date. The paper will conclude with a discussion of additional end-user applications and provide a summary of the user benefits of mobile satellite communications.

BACKGROUND

In support of its mandate to foster the development of improved telecommunications the Canadian Department of Communications (DOC) has held extensive meetings with mobile radio users to identify end-user requirements that are not currently satisfied by terrestrial systems. DOC initially took the lead in the promotion of mobile satellite (MSAT) services, conducting R&D and supporting market studies. Telesat Canada, and subsequently Telesat Mobile Inc. (TMI), eventually took over the lead for the implementation of MSAT when commercial viability was established and radio spectrum made available.

A very beneficial dialogue was established from the outset with end-users who provided substantial input critical to

establishing commercial viability and the need for government support in certain areas. This ongoing dialogue between DOC, Telesat and end-users over the years resulted in the definition and revision of various services to the current stage where TMI are well-positioned to respond to a very broad range of end-user requirements which are outlined below.

END-USER REQUIREMENTS

Existing mobile radio users in Canada identified many limitations to terrestrially-based mobile services. The following end-user requirements were developed in line with potential improvements that could be realized with satellite-based systems.

Geographical Coverage. Many Canadian-based end-users have identified a requirement to have mobile communications over the entire Canadian territory (including 200 miles offshore) and in many cases (e.g. truckers, railcar owners) all of North America. The current system concept for a regional North America-wide service^{1 2} that provides for "roaming" anywhere in North America will meet the requirements of most Canadian users except those operating in the Northern Arctic. Coverage beyond 80 degrees North latitude is not possible with MSAT, a geostationary satellite. Polar-orbiting satellites, are required for these very high-latitude applications.

Equipment Configuration. End-users have identified a requirement for the following land-mobile configurations; trucks, cars, busses, trains and battery-powered units for individual railcars. Maritime mobile equipment is required for government vessels (Coast Guard, Fisheries), ferry fleets, fishing vessels and fixed and floating buoys (battery-powered). Aeronautical mobile applications range from large passenger aircraft requiring full cockpit and passenger cabin voice and

data services to small single-engine bush planes with a requirement for "flight-following" and fleet management. As well as traditional mobile communications a significant MSAT market has been identified for a wide-range of SCADA (Supervisory Control and Data Acquisition) applications serving fixed platforms such as natural gas pumping stations, river flow gauges, avalanche monitors and lightning location detectors used in forest fire monitoring systems. A fifth broad category of equipment configuration identified by end-users was for transportable/portable, manpack and/or equipment described as "small hand-held radios providing wide-area communications coverage", the latter being along the lines of what is anticipated to be available as "personal communications" devices early in the 21st century. Man-pack communications are required, for example, by forest-fire fighters. Personal communications and geographic position-ing equipment (weighing less than a kilogram) is required by mineral claim inspectors and geologists travelling by aircraft, canoe and eventually on foot in the remote areas of Canada.

Telecommunication Services. The services required by end-users include voice, data, facsimile, and image transmission. The demand for voice ranges from half-duplex "field quality" (better than HF single sideband) for mobile radio applications to full duplex toll quality for mobile telephone. There is a major requirement for secure (encrypted) voice communications by government and private sector users such as those in the resource development sectors (oil and gas, mining, fishing).

Data transmission is required by a large group of end-users and this requirement ranges from once-per-day transmissions of a few bytes of information suitable for a packet switched service to full duplex circuit-switched data at 1200 bps and

higher for interconnection with corporate databases and electronic mail services. In the last few years there has been a much stronger interest in facsimile. The transmission of weather maps, updates to electronic marine charts and ice-flow information has also been proposed for MSAT.

In addition to 2-way voice and data communications, end-users have more recently responded very positively to various position location services such as LORAN C and GPS which, when coupled with 2-way messaging, provide an excellent overall fleet management service. The position location accuracies available from LORAN C (500 metres) meet the needs of most end-users such as long-haul truckers. Some end-users are looking forward to the much higher position accuracies available from GPS (Global Positioning System)³ when it becomes fully available in the mid 1990's. The use of differential GPS with accuracies of several centimetres has been proposed for monitoring the relative movement of adjacent sections of pipelines in, for example, mountainous areas subject to slides. The indication of a significant movement of adjacent segments of pipe beyond a given threshold would be sent by an event-triggered MSAT transmission.

Network Services and Capabilities. End-users are looking for complete end-to-end telecommunication services from a wide range of value-added service providers with knowledge of their specific requirements. Opportunities exist for entrepreneurs to provide much more than the actual telecommunications links between various mobiles/fixed platforms and their operations centres. Fleet managers and other users such as pipeline companies require either complete systems consisting of hardware and fleet management software systems or a communications system that can interface with existing corporate systems.

Users have identified requirements for fleet management systems with capabilities of communicating simultaneously in a broadcast mode to all mobiles or user-determined subfleet. Operators monitoring fixed platforms require the capability to access information by polling all platforms, addressing individual platforms or through "event-triggered" activations. The actual approach to the collection, presentation and storage of information is more important to end-users than how the information was obtained (e.g. by satellite vs. terrestrial link).

Because the full range of voice services will not be available until the launch of Canada's MSAT in 1993 Canadian end-users will be forced to examine the early mobile data services. The requirement for end-users to consider something other than the standard type of mobile voice offerings will probably in retrospect appear as beneficial to some end-users as outlined below.

FIELD TRIAL APPLICATIONS-MDS

Following is a description of some of the DOC field trial program applications that are being implemented (or are under consideration) through the TMI Mobile Data Service.

School Bus Fleet Management

The end-user has a requirement to provide "safety" communications between schools and school busses travelling on very long lightly-travelled routes subject to severe weather and temperatures lower than -40 degrees Celsius. Bus drivers need the capability to contact the school (or a dispatcher) to advise of breakdowns or accidents. Although the original field trial proposal called for voice communications, particularly during emergencies, this is one application that may very effectively be handled by the TMI

RoadKIT service, until such time as the full range of voice and data services are available in 1993. RoadKIT could provide a school with 15 minute updates on the location of busses operating on remote routes automatically without the requirement for driver intervention or a "dispatcher" constantly monitoring incoming radio calls. The driver would have the opportunity to send short messages indicating the nature of any breakdowns or delays. A more extreme scenario might involve a bus sliding off a highway and overturning in a blizzard. Radio equipment in this situation, even if it is an existing terrestrial system, may be unusable. In this latter case, with RoadKIT, the dispatch software could raise an alarm when regularly scheduled position reports are not received from busses.

Marine Data Trial

Under an Agreement with Sea Link Ltd. and an associated contract with Ultimateast Data Communications Ltd. of St. John's Newfoundland the DOC is conducting a marine data trial involving the participation of 5 end-user organizations. The objective is to conduct a marine data service market trial that will provide fleet management services for 3 government agencies (Canadian Coast Guard, Department of Fisheries and Oceans [DFO], Marine Atlantic coastal ferries) and 2 fishing companies (Fishery Products International, National Sea).

Shipboard Equipment. The radio transceiver being used for the trials is manufactured by Canadian Astronautics Ltd.⁴ For messaging services the shipboard end-user interface will consist of one of the following; PC (MS-DOS personal computer), laptop computer or Gandalf Systems Group Ltd. mobile data terminal.

Shore-based Equipment. A Sea Link/TMI Marine Network (MNET) will provide

interconnection between the vessels, the Telesat Mobile hub, Sea Link, end-user PC's or mainframe computers and various other networks such as public electronic mail services.

Services. The primary services defined include the automatic transmission of LORAN C position reports (requested by all field trial participants) and various types of 2-way messaging. DFO and Coast Guard messaging will include electronic mail and situation reports for fisheries patrol and search and rescue vessels. Marine Atlantic messaging will consist of EMAIL, arrival/departure information and cargo manifest. Fishing company messaging will include a "pro forma" ground fish catch log, digital weather station reporting and data related to temperature directed fishing.

Oceanographic Trial

The Canadian land mass is bordered by 3 of the world's oceans which have a major impact on the Canadian climate and contribute to the economy through fishing and recreational pursuits. The Arctic and Atlantic Oceans are subject to large iceflows that create hazards for fishing, transportation and offshore oil platforms. DOC is developing a field trial with the Bedford Institute of Oceanography and Seimac Ltd. of Dartmouth Nova Scotia in support of satellite-based monitoring of tethered and floating ocean data collection buoys. This oceanographic trial would involve "real-time" monitoring of weather and sea conditions for ice-flow prediction purposes and be a pioneer trial to a wide range of potential applications including the monitoring of remote navigational aids as well as research buoys deployed for oceanographic research.

DOC Radio Inspector Trial

As part of its mandate to manage the

radio spectrum, the DOC has a network of offices across Canada and an associated fleet of specially equipped vehicles to investigate radio interference problems, conduct inspections and monitor the radio spectrum. A trial will be undertaken in Northern Ontario to improve communications between DOC offices and radio inspectors in their vehicles. The general features of TMI's Mobile Data Services will be evaluated in an effort to increase efficiency, provide safety communications to drivers, and provide better response to complaints of harmful radio interference especially where safety radio services are affected. This particular "fleet management" application is typical of many that will be undertaken with various federal and provincial agencies requiring wide-area mobile communications services.

SCADA Trials

In support of several federal and provincial government agencies as well as the private sector, the federal government is supporting trials related to SCADA (Supervisory, Control and Data Acquisition) applications. Support is being finalized for the development of a transportable terminal that will operate from a rechargeable battery which can be charged from solar cells or other means for a long period of time without maintenance.

Discussions are underway with Munro Engineering of Calgary Alberta regarding field trials for clients in the oil and gas industry for applications that can supported with the Canadian Astronautics terminal.

Railcar Location Service

A field trial to support the implementation of a railcar location service employing a modified Canadian Astronautics terminal is under discussion with a value-added service provider and rail tankcar users.

FIELD TRIAL APPLICATIONS- TRANSPORTABLE VOICE TERMINALS

In addition to the Mobile Data Services being implemented commercially in 1990 by TMI, Teleglobe Canada will be implementing commercial voice services for 2 Ontario Air Ambulances⁵ and a limited number of SkyWave Electronics briefcase terminals.⁶ Field trials using 10 briefcase terminals will be conducted with more than a dozen end-users including Emergency Preparedness Canada, Canadian Coast Guard, Fisheries and Oceans, CBC Radio and Television Networks, 4 provincial governments, CTV Television and INCO Gold Mgt. Inc.

Because the satellite being used for the voice trials is only about one-tenth as powerful as MSAT, the trials relate primarily to transportable applications that allow the use of fixed directional antennas with higher gains than available from current mobile antennas. An adaptive array antenna developed at the DOC Communications Research Centre⁷ will be used for a land-mobile data trial and a maritime-mobile Canadian Coast Guard trial for voice and data applications.

BENEFITS

A highly-motivated group of future end-users of mobile satellite services has identified many potential applications and provided significant input in support of the definition of services to be offered on MSAT when it is launched in 1993, and other early-entry services provided with leased satellite capacity. Benefits to MSAT end-users resulting from the applications identified will include nation-wide coverage; increased efficiency, productivity, and customer satisfaction; increased reliability and quality of communication; confidentiality and improved safety.

REFERENCES

1. **Wachira, M.** 1990. Domestic Mobile Satellite Systems in North America. IMSC'90 Conference Proceedings Ottawa Canada
2. **Sward, D.** 1990. Mobile Data Services IMSC'90 Conference Proceedings Ottawa Canada
3. **Wells et al.** 1986 Guide to GPS Positioning Canadian GPS Associates Univ. of New Brunswick Graphic Services Fredericton, N.B.
4. **Sutherland, C.A.** 1990 A Satellite Data Terminal for Land Mobile Use IMSC '90 Conference Proceedings Ottawa Canada
5. **Butterworth, J.S.** 1988 Satellite Communications Experiment for the Ontario Air Ambulance Service Fourth International Conference on Satellite Systems for Mobile Communications and Navigation London England
6. **Rossiter, P. Reveler, D.** 1990 A Lightweight Mobile Voice/data Terminal IMSC '90 Conference Proceedings Ottawa Canada
7. **Milne. R.** An Adaptive Array Antenna for Mobile Satellite Communications IMSC '90 Conference Proceedings Ottawa Canada